PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A23G 9/20, 9/02

A1

(11) International Publication Number: WO 95/29597

(43) International Publication Date: 9 November 1995 (09.11.95)

(21) International Application Number: PCT/EP95/01429

(22) International Filing Date: 15 April 1995 (15.04.95)

(30) Priority Data:
94303145.0 29 April 1994 (29.04.94) EP
(34) Countries for which the regional or international application was filed: IT et al.

(71) Applicant *(for AU BB CA GB IE KE LK MN MW NZ SD SG SZ TT UG only)*: UNILEVER PLC [GB/GB]; Unilever House, Blackfriars, London EC4P 4BQ (GB).

(71) Applicant *(for all designated States except AU BB CA GB IE KE LK MN MW NZ SD SG SZ TT UG)*: UNILEVER N.V. [NL/NL]; Weena 455, NL-3013 AL Rotterdam (NL).

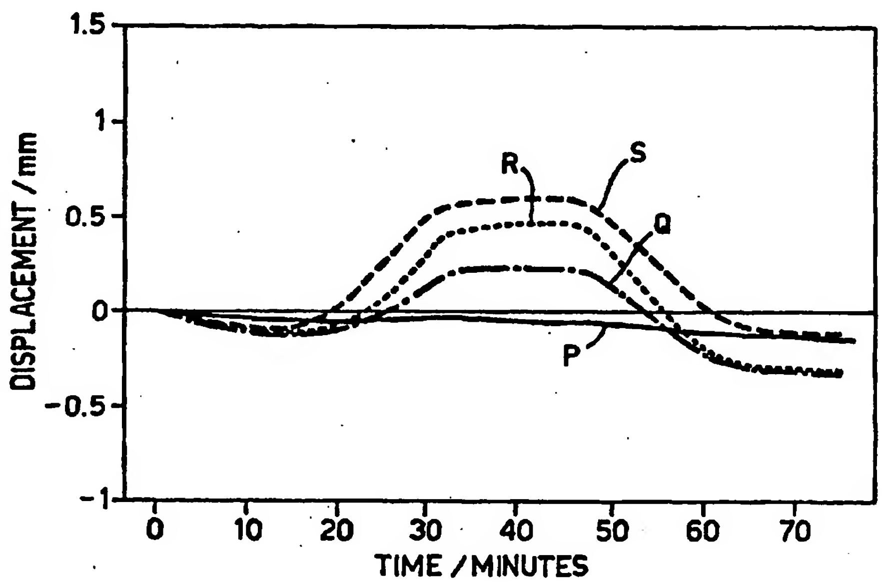
(72) Inventors: BAKER, Terence, Paul; 6 Swallow Drive, Rushden, Northampton NN10 9EG (GB). BEE, Rodney, David; 10 Stevenson Court, Eaton Ford, St Neots, Cambridge PE19 3LF (GB). DARLING, Donald, Frank; 34 Main Street, Denton, Northampton NN7 1DQ (GB). SAWANT, Vijay, Arjun; 10 Saxon Way, Raunds, Wellingborough, Northampton NN9 6PE (GB).

(74) Agent: KIRSCH, Susan, E.; Unilever plc, Patent Division, Colworth House, Sharnbrook, Bedford MK44 1LQ (GB).

(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).

Published
With international search report.

(54) Title: ICE CONFECTION AERATED WITH GAS



(57) Abstract

The volume change of an aerated ice confection under changes in ambient atmospheric is reduced by using, as the aerating component, a gas containing at least 60 % by volume of carbon dioxide, nitrous oxide and mixtures thereof.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CS	Czechoslovakia
CZ	Czech Republic
DE	Germany
DK	Denmark
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgystan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakhstan
LI	Liechtenstein
LK	Sri Lanka
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SI	Slovenia
SK	Slovakia
SN	Senegal
TD	Chad
TG	Togo
TJ	Tajikistan
TT	Trinidad and Tobago
UA	Ukraine
US	United States of America
UZ	Uzbekistan
VN	Viet Nam

Title: ice confection aerated with gas

Field of the invention: This invention relates to aerated ice confections. It is particularly applicable to milk protein containing confections, eg ice cream, ice milk, frozen yoghurt and frozen custards. These confections are prepared at low temperatures and are intended for consumption in the frozen state.

Background of the invention: The compositions of ice confections have developed over the years and a typical characteristic is the aeration of the composition. This feature is referred to as overrun and is quoted as a percentage ie

$$\%\ \text{overrun} = 100 \times \frac{\text{volume of product} - \text{volume of pre-aerated mix}}{\text{volume of pre-aerated mix}}$$

Levels of overrun maybe from about 20% to about 200% with the range for usual commercial products being from about 40% to about 150%.

The presence of a dispersed gas in the ice confection can lead to dimensional changes with change in ambient pressure. The ambient pressure will usually change as the ice confection is transported through a considerable geographic height difference or placed in an environment of continuous low pressure, eg an aircraft. The volume changes will be proportional to the volume of gas dispersed as discrete cells.

The effect of these dimensional changes can be apparent in packaged ice confections, for example in the movement of tub lids, and coated products in which the continuous coating, for example fat containing couvertures, will crack as the dimensional changes are transmitted to it.

General description of the invention:

The applicants have found the use, as aerating gas for an ice confection, of a gas containing at least about 60%, preferably at least about 70%, by volume of carbon dioxide, nitrous oxide and mixtures of these gasses reduces the dimensional changes. The remainder of the gas will typically be a nitrogen containing gas, eg air. The resulting aerated ice confection will then be shaped, eg by extrusion followed by cutting or moulding. The aerated ice confection may be packaged in a tub for sale, but a preferred form has a continuous coating formed on at least one surface. Thus this continuous coating, preferably a fat based couverture, may be on the top surface of an ice confection in a tub or preferably envelopes the ice confection to give a product in bar form or on a stick, as examples.

The products to which the invention relates will have at least about 3% fat content, more preferably at least about 8% fat.

It is believed the use of these water soluble ingestible gasses leads to the formation of channels within the bulk of ice confection. That is, soon after manufacture the gas phase forms a substantially continuous network which allows movement of gas through the bulk for release at the surface of the ice confection. This is in distinction from a gas distributed in discrete bubbles throughout the bulk.

The aeration is preferably performed at a gas pressure in the range from about 0.25 to about 6 bar absolute pressure.

Literature: Ice confections have been well characterised in the literature. General disclosures will be found in Ice Cream by W S Arbuckle (4th edition published by AVI

company of Connecticut USA) and Manual of Ice Cream by B Crowhurst (published by J G Kennedy of London England).

Specific description of the invention:

Examples of the invention will now be given to illustrate but not limit it with reference to the accompanying diagrammatic drawings in which:

Fig 1 shows the effects of aeration with air and carbon dioxide (100%),

Fig 2 shows the effects of aeration with air/carbon dioxide mixtures,

Fig 3 shows graphs demonstrating the effect of overrun,

Fig 4 shows the relationship between displacement and phase volume, and

Fig 5 shows the effects of aeration with nitrous oxide.

Example I

An ice cream composition containing

	% wt.
sucrose	17.00
butter oil	12.00
skimmed milk powder	7.00
stabiliser	0.70
whey powder	3.00
flavour (vanilla)	0.30
water	60.00

was prepared using standard procedures including a scraped surface heat exchanger. The overrun, at a level of 60%, was introduced by a standard method. The ice cream was

aerated with carbon dioxide (100%) at 0.5 and 4 bar freezer barrel pressure and both coated and uncoated products were tested.

The ice cream was extruded at -6°C and formed by moulding into blocks with the dimensions 25mm x 60mm x 100mm. It was then given a coating of standard couverture having a thickness of about 2mm by dipping.

Dimensional changes were measured by placing the sample, with large face uppermost, in a 25cm diameter desiccator positioned in a commercial ice cream freezer cabinet. A displacement transducer was positioned against the upper surface to that movement could be measured with time. The pressure and temperature in the desiccator were monitored.

The products were kept in the desiccator at -15°C for several hours under atmospheric pressure. The pressure was then reduced by 200 millibar over 15 minutes, held at the reduced pressure for 30 minutes and brought back to atmospheric over 15 minutes. The displacement in millimetres was measured over at least 2 hours. The displacement is shown in figure 1 in which the graphs are

A - aerated (CO_2) at 0.5 bar uncoated
B - aerated (CO_2) at 4.0 bar uncoated
C - aerated (CO_2) at 0.5 bar coated
D - aerated (air) at 4.0 bar coated (control)
E - aerated (air) at 4.0 bar uncoated (control)

These results show the displacements obtained with the present invention are considerably less than that obtained using air as the aerating component in controls D&E. The sudden increase in displacement at point x for the control coated product (D) is due to failure of the coating. Additionally the maximum displacement of D is above that of E because of amplified leverage by the coating. Product C shows essentially no displacement.

Example II

The procedure of Example I was repeated for uncoated ice confections using a gas containing 75% by volume carbon dioxide and 25% air prepared with a freezer barrel pressure of 4 bar. The results are shown in figure 2 in which the ice confections of the invention (F) were compared with a control gas (G) containing 25% by volume carbon dioxide with 75% air. The pressure change regime of Example I was used. It is seen the ice confection of the invention (F) had a negligible displacement with change in pressure compared with control G.

Example III

The presence of channels in the aerated ice confection is demonstrated by reference to figures 3 and 4. Figure 3 shows the effect of overrun on the displacement (mms) measured as described in Example I. The graphs of the aerated ice confection prepared using air at 4 bar, are identified as:

	% overrun	phase volume
H	5	0.05
J	20	0.17
K	60	0.38
L	100	0.50

The phase volume is the proportion of gas phase in the total volume of product.

Figure 4 shows the relative displacement of the Fig 3 examples represented as the ratio compared with the original surface height as unity. This displacement is plotted against the gas phase volume. The straight line M results from the expansion of the unconnected gas phase bubbles expanding and transmitting these changes to the

surface by hydraulic pressure as the ambient pressure falls.

The line N is the displacement ratio of an ice confection of the invention prepared as described in Example I. The proximity of this line to the unity axis demonstrates that aerating gas must be lost through channels defining a continuous gas phase within the product.

Example IV

Example I was repeated using nitrous oxide/air mixtures at 4 bar freezer barrel pressure. The samples were uncoated and retained at -15°C for 5 days under atmospheric pressure, that is a longer period than the several hours used in Example I. During 5 days storage the 60% overrun reduced to about 40%.

Figure 5 shows the displacement/time graphs for the nitrous oxide/air mixtures. The pressure was reduced by 200 millibar over 15 minutes, held at the reduced pressure for 15 minutes and then brought back to atmospheric pressure over 15 minutes. The displacement was measured (in mms) over 70 minutes.

- P - aerated with N_2O (95% vol)
- Q - aerated with N_2O (75% vol)
- R - aerated with N_2O (50% vol)
- S - aerated with air

The results show a relatively dimensionally stable ice cream is obtained after loss of some of the aerating gas. Similar results were obtained with samples coated with 2mm of couverture.

Example V

Using a mixture of carbon dioxide and nitrous oxide (50% volume of each) gives dimensional stability substantially the same as described in previous examples.

Claims

1. A method of preparing an aerated ice confection containing from about 20% to about 200% overrun in which a confection composition is mixed with an aerating gas which contains at least about 60%, preferably at least about 70%, by volume of carbon dioxide, nitrous oxide and mixtures thereof and subjected to a freezing step.

2. A method according to claim 1 wherein the overrun is from about 40%.

3. A method according to claim 1 or 2 wherein the overrun is up to about 150%.

4. A method according to claim 1, 2 or 3 wherein the aerated ice confection is shaped and then has a continuous coating formed on at least one surface.

5. A method according to claim 4 wherein the continuous coating is a fat-based couverture.

6. An aerated ice confection prepared by the method of any preceding claim.

Fig.1.

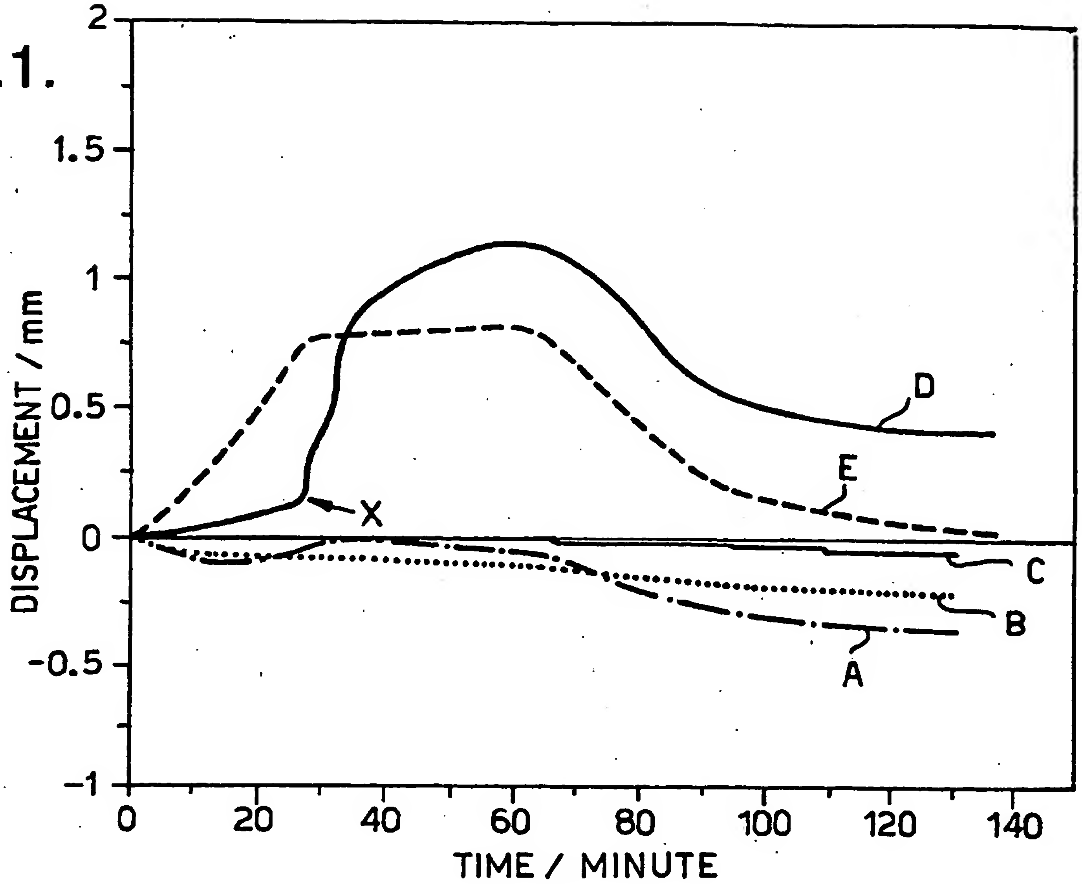

2
1.5
1
0.5
0
-0.5
-1
DISPLACEMENT / mm
0
20
40
60
80
100
120
140
TIME / MINUTE
D
E
X
C
B
A

Fig.2.

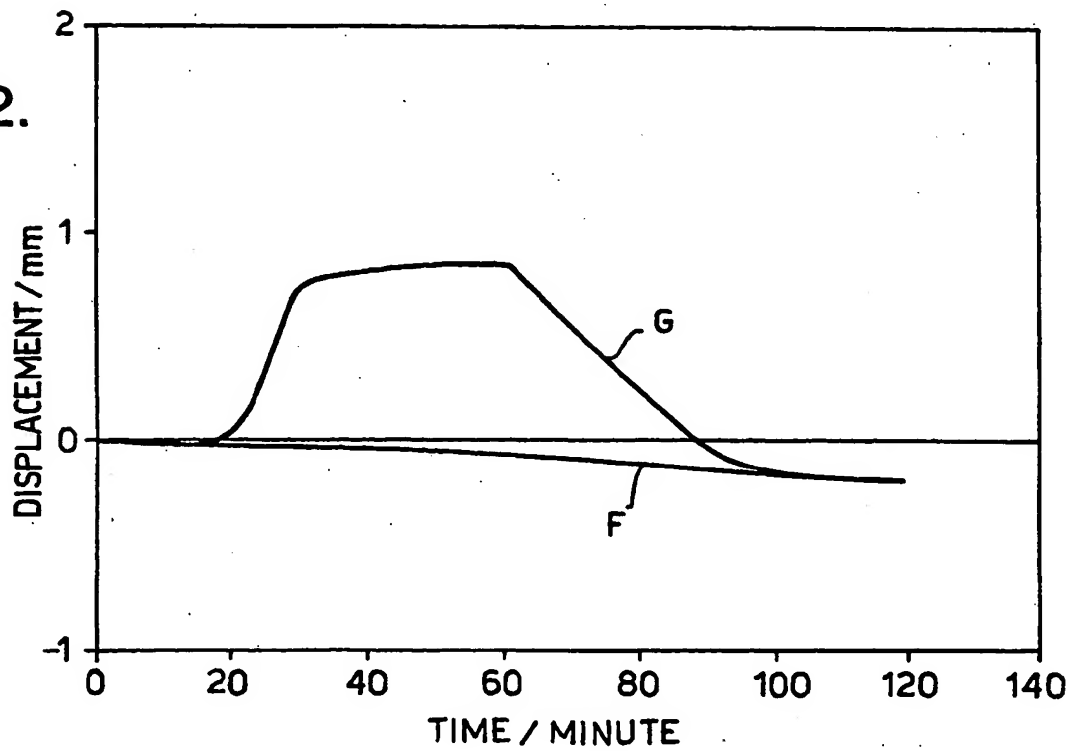

2
1
0
-1
DISPLACEMENT / mm
0
20
40
60
80
100
120
140
TIME / MINUTE
G
F

Fig.3.

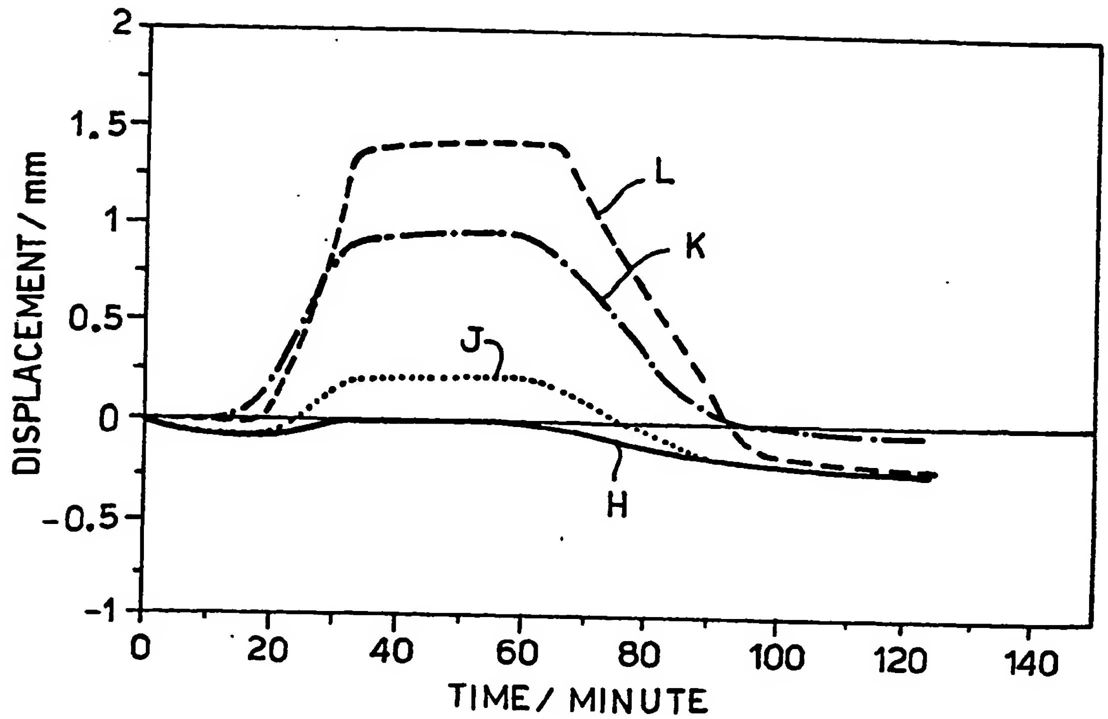

2
1.5
1
0.5
0
-0.5
-1
DISPLACEMENT / mm
0
20
40
60
80
100
120
140
TIME / MINUTE
L
K
J
H

Fig.4.

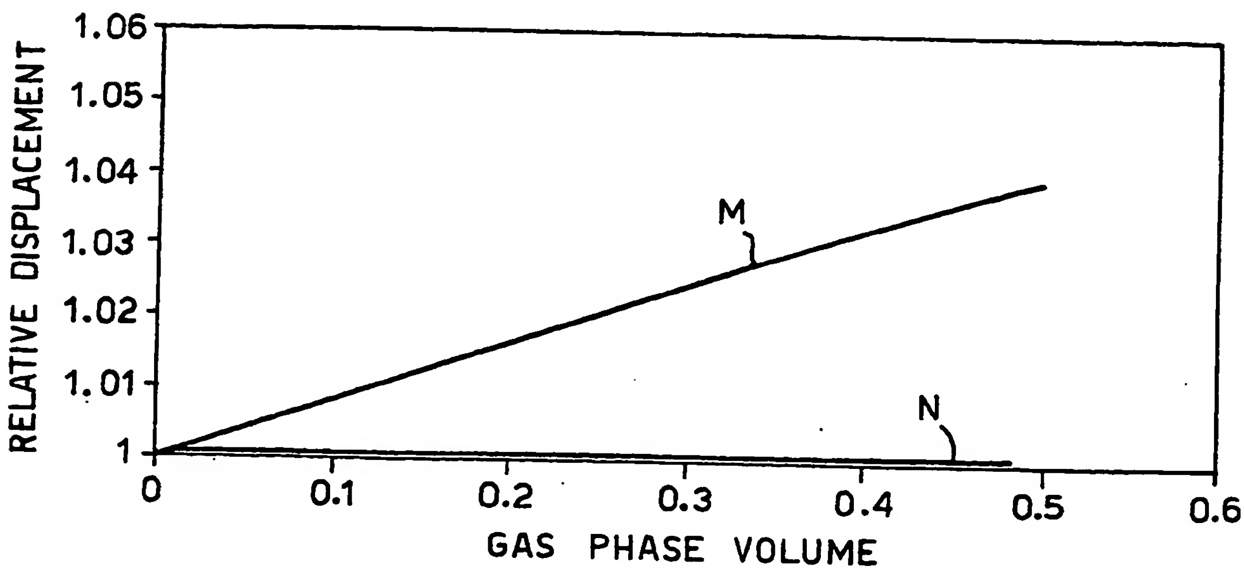
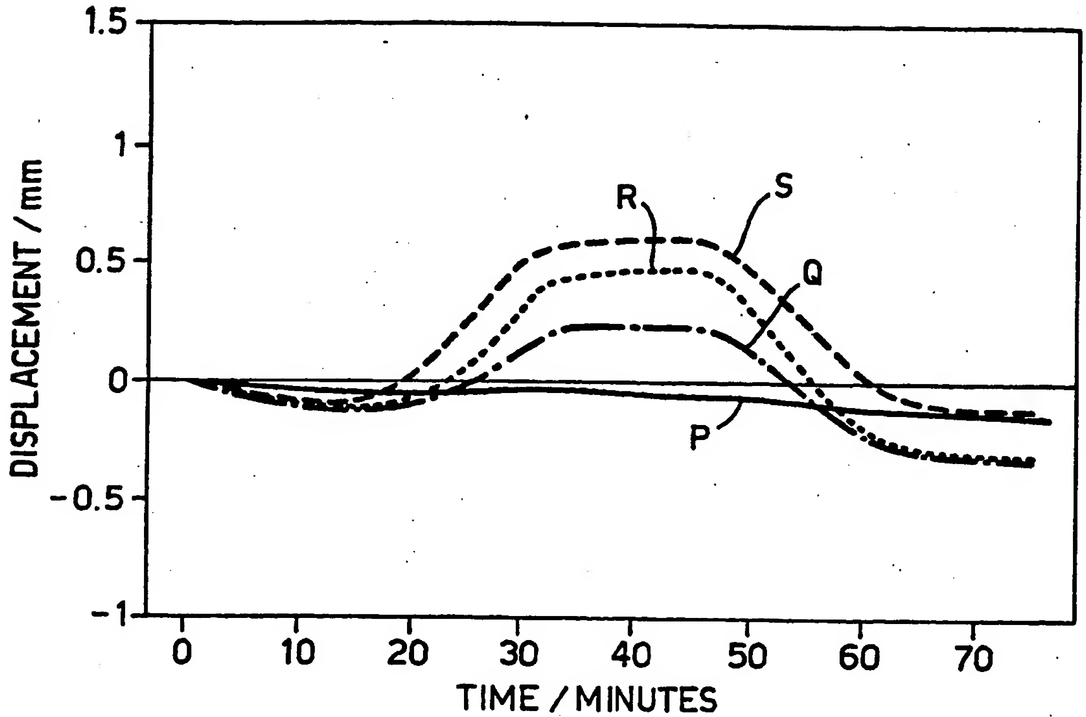

1.06
1.05
1.04
1.03
1.02
1.01
1
RELATIVE DISPLACEMENT
0
0.1
0.2
0.3
0.4
0.5
0.6
GAS PHASE VOLUME
M
N

Fig.5.


1.5
1
0.5
0
-0.5
-1
DISPLACEMENT / mm
0
10
20
30
40
50
60
70
TIME / MINUTES
R
S
Q
P

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 95/01429

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A23G9/20 A23G9/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US-A-3 503 757 (I. RUBENSTEIN) 31 March 1970 see column 3, line 19 - line 23; claims 1-3; figures ---	1,6
X	US-A-3 543 695 (I. RUBENSTEIN) 1 December 1970 see column 1, line 58-61; claims ---	1,6
X	WO-A-89 05588 (UNILEVER) 29 June 1989 see page 2, line 14 - line 19; claims 1,9; figures 1-5 ---	1-3,6
X	DE-A-26 35 117 (LINDE) 9 February 1978 see the whole document --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

3

Date of the actual completion of the international search	Date of mailing of the international search report
7 August 1995	21. 08. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Guyon, R

Form PCT/ISA/210 (second sheet) (July 1992)

Internal Application No
PCT/EP 95/01429

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 5 no. 85 (C-057) ,3 June 1981 & JP,A,56 029962 (ICHIHARA TAKUZO) 25 March 1981, see abstract -----	1

3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 95/01429

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-3503757	31-03-70	US-A-	3543695	01-12-70
US-A-3543695	01-12-70	US-A-	3503757	31-03-70
WO-A-8905588	29-06-89	GB-A-	2217174	25-10-89
		AU-A-	2901989	19-07-89
		CA-A-	1327483	08-03-94
		DE-A-	3868902	09-04-92
		EP-A,B	0322952	05-07-89
		JP-B-	6087746	09-11-94
		JP-T-	2501708	14-06-90
		US-A-	5017390	21-05-91
DE-A-2635117	09-02-78	NONE		